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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,598	01/29/2004	Max Krogager	821-55	5213

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EXAMINER	
DANIELS, MATTHEW J	

ART UNIT	PAPER NUMBER
1732	

DATE MAILED: 08/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)	
	10/767,598	KROGAGER ET AL.	
	Examiner	Art Unit	
	Matthew J. Daniels	1732	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. In the reply filed 19 May 2006, Claims 1-20 were amended, and new Claim 21 was presented. There are no cancelled claims.

Claim Objections

2. Objections set forth previously are withdrawn in view of the amended claims.

Claim Rejections - 35 USC § 112

3. Rejections set forth previously under this section are withdrawn in view of the amended claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 1, 8, 10, 11, 13, 15-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (Composite Repair Issues on the CF-18 Aircraft, AGARD Conference Proceedings, Vol. 550, pages 14-1 to 14-8). **As to Claim 1,** Russell teaches (Pages 14-1 to 14-3) a method for filling pores between two adjacent layers of a laminate for a component with high demands upon strength and comprising several layers of fiber composite having within each layer substantially

parallel fibers embedded into a matrix (Page 14-5, right column), in which at least said two adjacent layers have fiber directions differing substantially (Page 14-5, right column, the "stacking sequence" corresponds to different layers having differing angles), which comprises the steps:

a) a connection path, through which a medium may move inside the laminate, is created between the exterior of the laminate and the pore (paragraph bridging pages 14-3 and 14-4, "delaminations", and entry and exit holes shown in Fig. 5 on 14-3),

b) a flowing, curable material is applied at one outer surface of the laminate and brought to fill the pore through said connection path (Page 14-3, Fig. 5), and

c) the material filling the pore is brought to cure (page 14-2, left column, first paragraph).

Russell appears to be silent to the limitation "characterized in that in step a) said connection path is created by exerting the laminate at least in the region of said pore to forces making slots propagating substantially in the matrix through each laminate layer along the fiber direction of the layer."

However, the Examiner's position is that this limitation is inherent or prima facie obvious over the method of Russell. Russell teaches penetration damage to panels created using a high speed gas gun facility (Page 14-5, right column, last four lines) or drilling (see exit and entry holes in Fig. 5, page 14-5). It is the Examiner's position that such a gas gun would inherently create connection paths by exerting upon the laminate forces making slots propagating in the matrix and through each laminate layer along the fiber direction. Additionally, Russell teaches a drilling process to repair the delaminations, and drilling would obviously expose the laminate to forces making additional slots of fissures. As evidence, the Examiner cites Russell's numerous

teachings of delaminations, which propagate between layers of the stacked fiber sequences. Additionally, a high speed gas gun would create connection paths through the layers. **As to Claim 8**, Russell teaches a heater applied over the area of the laminate to be repaired (Fig. 5). Heating would have obviously been heated in connection with step (b) of Claim 1. **As to Claim 10**, Russell teaches negative air pressure applied on the laminate so as to facilitate the transport of the flowing material into the laminate through the slots (Vacuum in Fig. 5, Page 14-3). It should be noted that Russell teaches vacuum applied on the same side as the flowing resin, however, Russell does so because the method is directed at aircraft panels which cannot be removed or accessed from the opposite side. However, it is the Examiner's position that application of vacuum to either side of smaller panels would have been prima facie obvious to the ordinary artisan as an obvious variation over Russell's method. **As to Claim 11**, Russell teaches carbon fiber and epoxy (Battle Damage Repair on page 14-5). **As to Claim 13**, Russell teaches epoxy, which is flowable and curable inherently (Fig. 5, "Resin" and page 14-3). **As to Claims 15 and 17**, Russell teaches angles of 45 degrees and 16 layers (See Delamination Repair on 14-3, particularly the portion 45/-45/0/45/-45/90/45/-45/90/45/-45/0/45/-45/90/0). **As to Claim 16**, Russell teaches (14-5, lower right column) a laminate stack of 20 layers having a thickness of approximately 3.5 mm. This is an average layer thickness of 0.175 mm per layer. **As to Claim 18**, Russell teaches filling pores having of 5 cm in diameter (See Delamination Repair, 14-3, lower right). This is larger than the claimed 36 square millimeters. **As to Claim 19**, while intended uses are not given patentable weight in this case, it is noted that Russell teaches particular and distinct applicability to flying vehicles (See the title and text).

5. **Claims 2-5, 20, and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (Composite Repair Issues on the CF-18 Aircraft, AGARD Conference Proceedings, Vol. 550, pages 14-1 to 14-8) in view of Wilenski (Evaulation of an E-Beam Cured Material for Cryogenic Structure Usage, 47th International SAMPE Symposium, 2002, pages 109-123). Russell teaches the subject matter of Claim 1 above under 35 USC 103(a). **As to Claims 2-5**, Russell teaches confining an area of the laminate (Fig. 5) for repair of a damaged area.

However, Russell appears to be silent to cooling to contract and create slots (Claim 2), cooling to –70 C (Claim 3), cooling by applying liquid nitrogen or carbon dioxide snow on the laminate (Claim 4), applying cooling medium on the laminate within a restricted region (Claim 5). However, Wilenski teaches cooling with liquid nitrogen (LN2), which is inherently between –70 C and –150 C (Fig. 14, Page 121). While Wilenski appears to be silent to confining the area of liquid nitrogen application, the Examiner submits that it would have been prima facie obvious in view of Russell's teachings that heating also be confined (Fig. 5). One of ordinary skill would have found it obvious not to treat the whole airplane structural component to repair confined damage. In the combined method, Russell provides the confinement, and Wilenski teaches cooling to the claimed temperature by applying liquid nitrogen.

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Wilenski into that of Russell because doing so would:

a) increase the permeability of the composite, which would obviously allow improved resin flow through the composite when repairing it with Russell's method. See Wilenski's Fig. 14, and the increase in permeability for LN2 for either Specimen #3 or Specimen #4.

b) provide a method for repairing composite samples which have developed cracks as a result of cryogenic drilling or thermal fatigue testing.

c) create compressive strains that are frozen into the composite part, which help prevent renewed crack formation and increase fatigue resistance.

As to Claim 20, Russell is silent to the liquid nitrogen and carbon dioxide snow. However, Wilenski teaches this aspect (Fig. 14, Page 121). **As to Claim 21**, Wilenski teaches at least liquid nitrogen, and Applicant's specification admits that this produces the claimed temperature of below –150 degrees C.

6. **Claims 6,7, 9, and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (Composite Repair Issues on the CF-18 Aircraft, AGARD Conference Proceedings, Vol. 550, pages 14-1 to 14-8) in view of Kessler (Self-Activated healing of delamination damage in woven composites, Composites: Part A, Vol. 32, 2001, pages 683-699). **As to Claims 6, 7, and 9,** Russell appears to be silent to application of forces to the composite during the repair.

However, Kessler teaches that this aspect is common in the art (Fig. 6 and section 3.2 Reference Specimens on page 688). Specifically, Kessler teaches applying forces transverse to the fiber directions and between layers using the apparatus shown in Fig. 2, page 685. In Kessler's method, the catalyzed resin is then injected into the crack while under tension, and released (See "DCPD & catalyst injected" in Fig. 6). This produces the desirable results of stable crack propagation through the healed region and strength values comparable to the virgin material (Page 688, left column, "Retesting after 48 h ..." in lower left corner). Kessler's method would have obviously (Claim 6) exerted such outer forces in planes transversely to the

fiber direction that slots propagate along the fiber direction of the layer (Fig. 2, page 685), (Claim 7) opened the slots and facilitated flowing material to the pore, and removal of the forces before curing (See "DCPD & catalyst injected" in Fig. 6, and "specimen was unloaded" in lower left column of page 688), and inherently pressing superfluous material out of the slots, and (Claim 9) applied forces transversally to the fiber directions of the different layers so as to open the slots when applying the flowing material on the outer surface of the laminate for facilitating the transport of the flowing material to the pore (See "DCPD & catalyst injected" in Fig. 6, and "specimen was unloaded" in lower left column of page 688).

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Kessler into that of Russell in order to provide a stable crack propagation throughout the healed region (lower left column of page 688) and a strength value comparable to the virgin material (Fig. 6). **As to Claim 12**, Kessler teaches glass fiber and epoxy composites (Page 688, Reference Specimens).

7. **Claims 6,7, 9, and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (Composite Repair Issues on the CF-18 Aircraft, AGARD Conference Proceedings, Vol. 550, pages 14-1 to 14-8) in view of Rau (USPN 4737330). **As to Claims 6, 7, and 9,** Russell appears to be silent to application of forces to the composite during the repair.

However, Rau teaches this aspect of the invention. Specifically, Rau's method would have obviously (Claim 6) exerted such outer forces in planes transversely to the fiber direction that slots propagate along the fiber direction of the layer (Figs. 1-4, Items 2 and 3), (Claim 7) opened the slots and facilitated flowing material to the pore, and removal of the forces before

curing (2:30-35), and inherently pressing superfluous material out of the slots, and (Claim 9) applied forces transversally to the fiber directions of the different layers so as to open the slots when applying the flowing material on the outer surface of the laminate for facilitating the transport of the flowing material to the pore (Figs. 1-4, Items 2 and 3).

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Rau into that of Russell in order to provide compressive strains that are frozen into the composite part, which help prevent renewed crack formation which may occur in the component part during operation, increasing fatigue resistance (Rau, 2:29-42).

8. **Claim 14** is rejected under 35 U.S.C. 103(a) as being unpatentable over Russell (Composite Repair Issues on the CF-18 Aircraft, AGARD Conference Proceedings, Vol. 550, pages 14-1 to 14-8) in view of Dehm (Fast, In-Situ Repair of Aircraft Panel Components, J. Aircraft, Vol. 26, No. 5, 1989, pages 476-81). Russell teaches the subject matter of both claims 8 and 13 above under 35 USC 103(a). **As to Claim 14**, Russell teaches a heater (Fig. 5), but appears to be silent to particular temperatures. However, Dehm teaches that in the repair of aircraft panels using resin, viscosity decreases with increasing temperature (Fig. 1). In particular, Dehm appears to show a) that temperatures of 40 C or greater are desirable and b) that resin temperature appears to represent a result-effective variable that can be optimized. See MPEP 2144.05 II and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In this case, the claimed temperature would have been prima facie obvious in Dehm's method.

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Dehm into that of Russell in order to lower the viscosity and provide enhanced spreading of the resin (Page 476, right column).

Response to Arguments

9. Applicant's arguments filed 19 May 2006 have been fully considered but they are not persuasive. The arguments appear to be on the following grounds:

a) Applicants disagree that Russell teaches the penetration damage would create connection paths by exerting upon the laminate, forces making slots propagating in the matrix and along the fiber direction.

b) Applicants assert that a connection path is created by exposing the laminate in the region of pores to forces making thin slots or fissures. The force must produce thin slots of fissures substantially propagating through the matrix.

c) Russell recites the use of a drill that makes coarse holes and/or the use of a high speed gun facility to produce damage. Both are structurally distinct from thin slots or fissures.

10. These arguments are not persuasive for the following reasons:

a) The Examiner maintains the position set forth in the previous rejection and asserts that either the gas gun or the drilling action which takes place during the repairing process of Russell would provide a force that would create slots of fissures. Russell's Fig. 5 on page 14-3 shows the delaminations produced by impact testing as horizontal lines in the laminate, and it is unclear how these cannot be intpreted to be thin slots or fissures. By their depiction in Fig. 5 as lines,

instead of as voids, the Examiner maintains that the interpretation of these defects as "thin slots or fissures" is valid. The drilling of entry and exit holes for the resin would have obviously enlarged these existing defects or created new defects. As evidence only of this position, the Examiner also cites Bhattacharyya (A Study of Hole Drilling in Kevlar Composites, Composites Science and Technology, Vol. 58 (1998), pages 267-283), who teaches on page 278 (Fig. 16) that drilling applies a force which would cause thin slots of fissures. In particular, see Bhattacharyya's teachings in the paragraph bridging pages 277 and 278 for teaching that "One other important finding from the scanning results was that almost every hole would show some signs of delamination around the drilling zone." (emphasis added) The Examiner maintains the position that either the impact testing or the drilling reads on the claimed step.

b and c) The Examiner asserts that Russell's teaching in Fig. 5 of horizontal crack propagation lines propagating through a horizontally layered composite suggests to the ordinary artisan that the defects propagate through the matrix. No particular limitations have been set forth which distinguish the thin slots or fissures from those disclosed by the reference.

The rejections of Claims 2-20 were not particularly argued aside from their dependence on Claim 1.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Daniels whose telephone number is (571) 272-2450. The examiner can normally be reached on Monday - Friday, 8:00 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on (571) 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MJD 8/3/06

CHRISTINA JOHNSON
PRIMARY EXAMINER
8/4/06